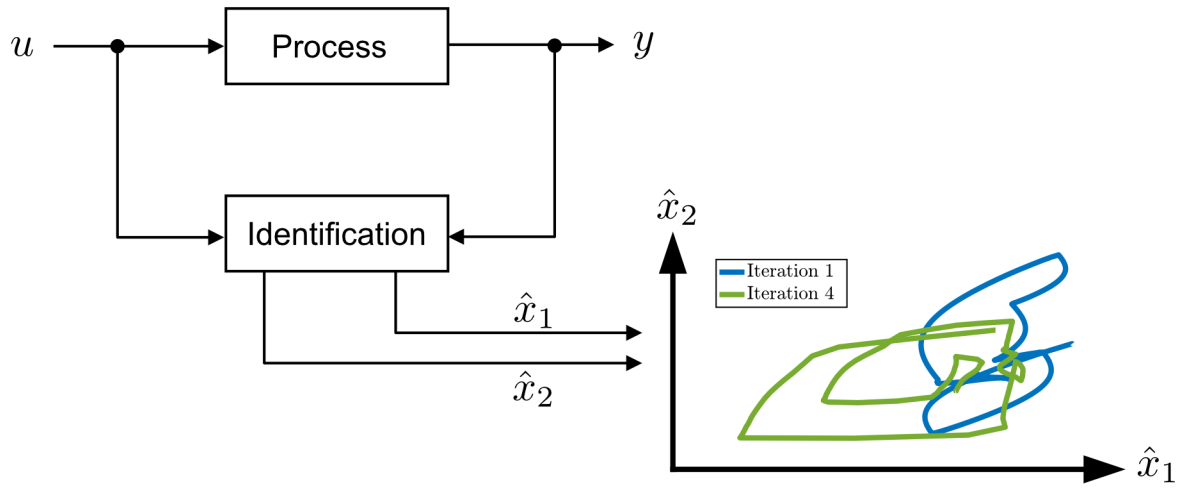
Universität Siegen – Department Maschinenbau
Institut für Mechanik und Regelungstechnik – Mechatronik
Arbeitsgruppe Mess- und Regelungstechnik
Prof. Dr.-Ing. Oliver Nelles

26.01.2023

Bachelorarbeit / Masterarbeit / Studienarbeit

Trajectory Characterization for Identification of Nonlinear State Space Models

In Machine Learning recurrent model structures are commonly used for identification of dynamic processes. In case of complex systems with internal dynamics, state space models provide the necessary structural flexibility. In combination with local model networks, which describe the nonlinearity by an interpolation of local linear models, a powerful model architecture arises, called Local Model State Space Network (LMSSN). This model type has shown competitive performance on different benchmarks.
The scope of this thesis is to analyze the internal states during the data-driven parameter identification of LMSSN. While iteratively optimizing the model parameters, the state trajectory performs movements and deformation in the input/state space because of its dependency on the parameters. An example can be seen in the following figure.



The deformation of the trajectory, especially shrinking, has consequences for state space transformations. Certain cases shall be searched and provoked with the help of synthetic examples processes. Furthermore, the trajectories shall be characterized with suitable shape indicators.

Work Packages:

- Development of Wiener and Hammerstein systems as example processes for data generation
- State space modeling with the LMSSN toolbox
- Study of state trajectories and evaluation with detection tools and geometric measurements
- Documentation of results

Kontakt:
M.Sc. Hermann Klein
Tel.: +49 (0) 271 740 - 5521
E-Mail: hermann.klein@uni-siegen.de